RESEARCH UPDATES

Diversity in Omani Wheat Landraces

An Omani wheat landrace in the field

About 10,000 years ago, wheat was domesticated in the Levant Region. It is believed that from that region, 3,000 years ago, wheat was introduced into Oman. Since then, it has been cultivated in various oases of the country resulting in large genetic diversity adapted to the marginal conditions and high temperatures of Oman. It is believed that preserving this genetic diversity directly benefits farmers growing wheat on these marginal lands. To explore further the genetic diversity, ICBA has been indentifying the various Omani wheat landraces and comparing traits that are valuable to farmers.

A landrace is a dynamic population of a cultivated plant that has historical origin, distinct identity and has not been subject to formal crop improvement. A landrace is often genetically diverse, locally adapted and associated with traditional farming systems. By their very nature wheat landraces are more genetically diverse than the current high yielding varieties that have a narrow genetic base. This means that they are a valuable source for plant breeders working to develop plant varieties with certain desired characteristics such as salinity tolerance. Landraces, also called traditional varieties, are under severe threat of genetic erosion mainly due to urbanization and to their replacement by new genetically uniform varieties.

In Oman, wheat has never been a major crop. In 2011, about 640 hectares were under wheat cultivation, down from 1,000 hectares in 1961. The ancient low yielding wheat landraces cultivated in Oman has decreased by 75% in a span of 8 years. Now, mostly modern high yielding varieties are planted for wheat production with the ancient landraces grown in far-flung oases of the Sultanate.

Omani wheat landraces (*Triticum* spp.) show a broad spectrum of diversity with at least five species, i.e., *Triticum. aestivum*, *T. aethiopicum*, *T. compactum*, *T. dicoccon* and *T. durum*. Two of these species (*T. aestivum* and *T. compactum*) are hexaploids meaning they have six sets of chromosomes, while the other three species are tetraploids (four sets of chromosomes). The diversity in Omani wheat landraces is due to its geographic location as well as its ancient trade relationships with the Far East, South Asia, East Africa and the Middle East. In Oman, usually both tetraploid and hexaploid landraces are cultivated together. When different kinds of wheat genotypes are grown together in the same field, it may lead to hybrid swarms; another reason for the genetic diversification of Omani wheat.

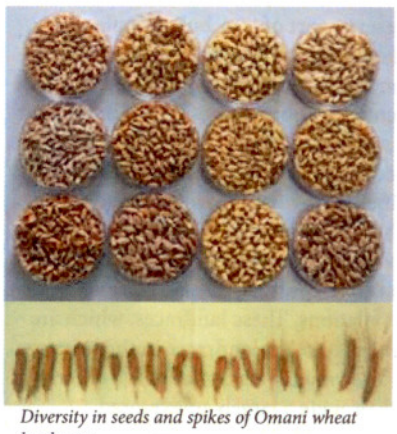
Spike of a typical Omani wheat landrace

Due to the genetic value of Omani wheat landraces, ICBA started research to identify available Omani wheat landraces, compare their traits, and preserve part of it. A bulk sample of wheat seed was obtained from a farmers' market in Oman and then planted to identify components of the landrace, and to select maximum diversity within the seed sample for a follow-up study. Different agronomic characteristics (Table 1) were studied to determine the diversity among the wheat landraces. The research identified five landrace populations. These landraces, which are similar to other landraces in the primary and secondary centers of wheat diversity, can provide a largely unexplored diversity with great potential for broadening the genetic base of modern wheat cultivars (Table 1).

Table 1: Trait least square means

	Landrace 1	Landrace 2	Landrace 3	Landrace 4	Landrace 5
Plant height, cm	66.98	69.43	86.79	91.35	101.45
Spike length, cm	10.24	11.92	9.62	9.46	13.43
Awn length, cm	3.42	4.69	2.44	2.24	6.15
Spikelets/spike	16.83	17.54	22.51	20.74	23.98
Seeds/spike	33.82	46.97	67.54	47.83	81.22
Spike density	3.72	4.48	8.215	5.84	7.40
Seed length, mm	6.51	6.16	6.31	6.33	3.27
Seed width, mm	2.80	2.95	2.97	2.90	2.98
Seed size, mm^{-3}	2.36	2.11	2.16	2.22	2.15
100-seed wt, mg	3.22	3.28	3.20	3.34	3.45
Days to heading	100.06	82.33	92.13	93.34	89.83
Days to maturity	133.60	125.80	128.53	128.98	126.22
Filling period, days	33.57	43.51	36.39	35.62	36.39
Spike/Plant length	0.16	0.17	0.11	0.10	0.13
Awn/Spike length	0.27	0.35	0.17	0.16	0.35
Spikelet fertility	2.03	2.72	3.04	2.34	3.40

Local landraces may provide new alleles (DNA codings that determine distinct traits that can be passed on from parents to offspring) for the improvement of commercially valuable traits in wheat, including quality traits and adaptation to biotic stresses (stress caused by living organisms such as insect pests and diseases) and abiotic stresses (stress caused by salinity, heat, water scarcity, etc.). In ICBA's study, it was found that landrace populations are characterized by large diversity at different hierarchal levels (Jaradat & Shahid 2013). It was concluded that the five landrace populations identified, similar to other landraces in the primary and secondary centers of wheat diversity, can provide a largely unexplored diversity with great potential for broadening the genetic base of modern wheat cultivars. However, landraces may have some undesirable traits, such as susceptibility to lodging and low average yields. Nevertheless, they are retained because they are a low risk option under marginal conditions, resulting in fewer poor production years.



Diversity in seeds and spikes of Omani wheat landraces

In conclusion, the landrace populations identified in the study are highly diverse and constitute valuable sources of traits for adaptation to marginal wheat-growing parts of the world with high temperature and salinity, and may have gene complexes to combat climate change. However, the utilization of this genetic diversity needs systematic evaluation of many traits, especially those of quality significance and those that confer adaptation to climate change.

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Reference:

Jaradat & Shahid 2013. EJFA 26:16753 (in press)